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ENGINE COOLING FAN WITH ELECTROMAGNETIC CLUTCH

APPARATUS FOR CONVEYING AIR TO COOLING FLUIDS OF MOTOR VEHICLES AND THE LIKE WITH FAN COMPRISING DIRECTABLE BLADES AND MEANS FOR ENGAGING/DISENGAGING THE MOVEMENT OF THE FAN

SPECIFICATION

FIELD OF THE INVENTION

DESCRIPTION

The present invention relates to an apparatus for conveying air to radiators of motor vehicles and the like, comprising a fan with directable blades and means for engaging/disengaging the transmission of the rotational movement to the said fan.

BACKGROUND OF THE INVENTION

It is known in the technical sector relating to the treatment of cooling liquids contained in the radiators of motor vehicles or the like that there is a need to force an air flow through the said radiator in order to obtain more rapid dissipation of heat from the cooling liquid to the exterior. The said forced air flow is obtained by causing the rotation of an apparatus which is normally mounted either directly on the driving shaft or on the shaft of the water pump or on a driven shaft carrying a pulley which is connected by a belt to the driving shaft itself.

An apparatus which allows continuous adjustment of the quantity of air forced onto the heat exchanger which cools the fluid are also known. Thus said apparatus has comprising essentially a central body mounted on a rotating support and a plurality of blades radially mounted by means of associated coupling devices on said central body, said blades being rotatable about their respective longitudinal axes upon operation of movement actuating and transmission means forming part of the said apparatus.

An example of such an apparatus is that for example described in EP 0,967,104 in the name of the present Applicants.

Although performing their function, such apparatus

nevertheless have the drawback that the blade-support assembly continues to rotate even when the angle of incidence of the blades is at a minimum, thus resulting in an undesirable drawing of power with an associated increase in the consumption and a constant noisiness, even when the climatic and operating conditions are such that the cooling fan need not be used.

The technical problem which is posed, therefore, is that of providing a ventilation apparatus for conveying the air cooling the cooling liquid in motor vehicles or the like, which allows continuous adjustment of the flow of forced air onto the heat exchanger containing the cooling liquid and which also allows interruption in operation of the said apparatus, when it is not required to force air onto the fluid for cooling thereof.

These technical problems are solved according to the present invention by an apparatus for conveying air to radiators of vehicles and the like, comprising a fan having a plurality of blades each radially mounted by means of its own coupling device on a central body and able to be rotationally actuated about its longitudinal axis by means of actuating means depending on the quantity of air required for correct cooling of the fluid, said apparatus comprising means for engaging/disengaging the transmission of the rotational movement from the means generating said movement to the said fan.

Further details may be obtained from the following description of a non-limiting example of embodiment of the invention provided with reference to the accompanying drawings, in which:

- Figure 1 is a schematic cross-section along a plane transverse to the axis of the apparatus according to

the present invention, illustrating the known blade directing devices;

Figure 2a is a schematic cross-section along the plane indicated by II-II in Fig. 1, illustrating a first example of embodiment of the apparatus according to the present invention;

Figure 2b is a schematic cross-sectional view, similar to that of Fig. 2a, of a second example of embodiment of the apparatus according to the present invention;

Figure 2c is a cross-sectional view, similar to that of Fig. 2a, of a third example of the apparatus according to the invention;

Fig. 3a is a cross-sectional view, similar to that of Fig. 2a, of a fourth example of the apparatus according to the invention;

Fig. 3b is a cross-sectional view, similar to that of Fig. 3a, of a fifth example of an apparatus according to the invention;

Figure 3c is a cross-sectional view, similar to that of Fig. 3a, of a sixth example of an apparatus according to the invention;

Figure 4a is a cross-sectional view, similar to that of Fig. 2a, of a seventh example of an apparatus according to the invention; and

Figure 4b is a cross-sectional view, similar to that of Fig. 4a, of an eighth example of an apparatus according to the invention.

SPECIFIC DESCRIPTION

As illustrated in Figs. 1 and 2a, the apparatus 10 for cooling the cooling liquid of motor vehicles and the like according to the invention is mounted on a supporting and movement transmission device 20 comprising a rotor 21, rotating on bearings 21a keyed onto a mounting block 22 which is integrally joined to the body 22a of the engine by means of bolts 22b or the

like, which mounting block extends in the longitudinal direction with a fixed shaft 21a on which the apparatus 10 is mounted with the arrangement, in between, of respective bearings described below.

The rotor 21 is kept constantly rotating by means of a pulley 23 integral with the rotor itself and connected in a known manner to a shaft of the vehicle engine.

The apparatus 10 essentially consists of a central body 11 on which the blades 12 which cause the flow of the air from the outside towards the radiator (not shown) containing the cooling liquid are radially mounted.

In the example of embodiment shown, each blade 12 has an end inside the central body 11, consisting of a pivot pin 31, with cylindrical teeth 31a, which is radially mounted by means of bearings 31b on the body 11. In this way each blade 12, in addition to rotating with the fan 10 on the support 21a, is also able to rotate about its longitudinal axis 12a.

Each gearing 31a is in fact coupled to an actuating device consisting of an associated straight rack 41a integral with a coaxial disk 41 inserted inside a respective seat 51a of a sleeve 51 mounted on the shaft 21a by means of associated bearings 52 which allow the free rotation of the sleeve itself, and therefore the fan integral therewith, relative to the shaft 21a.

The disk 41, and therefore the rack 41a, is constantly pushed in the opposite direction to that of the blades 12 by resilient means, consisting by way of example of a coaxial spring 42, there being envisaged means 43, inside the fixed shaft 21a, for supplying a fluid under pressure, able to overcome the thrusting force of the spring 42 in order to cause advancing of the disk 41 and therefore rotation of the blades 12.

As can be seen, the blade actuating device is able to ensure the rotation, in a continuous manner, of all the

blades simultaneously and in the same direction through a suitable angle, which is in each case defined according to operating requirements.

In order to cause stoppage of the fan independently of the direction of the blades, it is envisaged that the apparatus is provided with means for engaging/disengaging the transmission of the rotational movement from the means generating the said movement to the fan unit.

In greater detail said engaging/disengaging means consist (see Fig. 2a) of an electromagnetic clutch 60 comprising:

/ an electromagnet 61, which is fixed to the support 22 and inserted in a corresponding seat of the rotor 21, the electromagnet being supplied with current by means of associated conductors 61a connected to the devices (not shown) for detecting and controlling the temperature; and

/ an armature 62, which is integrally joined to the sleeve 51 of the fan 10 with the arrangement, in between, of a ring 63 having a high radial rigidity, but resiliently deformable in the axial direction so as to allow a corresponding axial movement of the said armature.

With this configuration it is envisaged that the electromagnet is normally de-energized and that fluid under pressure is not supplied to the disk 41; as a result the clutch is disengaged and the fan remains immobile with the disk 41 pushed by the spring 42 into a position corresponding to the maximum angle of the blades and therefore the maximum quantity of air which can be supplied to the radiator.

On the other hand, energization of the electromagnet 61 produces an electromagnetic field which, overcoming the resistance of the ring 63, recalls the armature 62 in

the axial direction, connecting, by means of friction, the rotor 21 to the fan 10 which starts to rotate.

According to requirements it may also be possible to adjust the angle of the blades 12 by supplying a suitable quantity of fluid under pressure to the duct 43.

In the variation of embodiment according to Fig. 2b it is envisaged that the clutch 160 comprises resilient means 164 arranged parallel to the longitudinal axis of rotation - inside the rotor 161 in the example - which are able to push the armature 62 axially against elements 165 with a high coefficient of friction frontally integral with the sleeve 51.

In this case, the electromagnet is normally de-energized and no fluid under pressure is supplied to the duct 43 so that the springs 164 constantly keep the sleeve 51 coupled to the rotor 61 and the blades are rotated into the maximum angular position in order to ensure constant rotation of the fan 10 and supplying of the maximum quantity of air to the radiator, also in the case of interruption in the control current.

Energization of the electromagnet, on the other hand, produces a magnetic force of attraction which, overcoming the thrust of the springs 164, axially attracts the armature 62 which, being separated from the friction material 165, disengages the clutch, stopping rotation of the fan 10.

In the example of embodiment according to Fig. 2c, it is envisaged that the clutch 260 comprises an armature consisting of a disk 262 coaxially fixed to the sleeve 51 and that coupling is produced by jaws 261a,261b of a gripper 261 able to close around said armature 262 upon operation of respective actuating means.

In greater detail, the jaw 261a is fixed and integral with the rotor 221, while the jaw 261b constitutes the

piston of a cylinder and is movable translationwise in an axial direction and in both senses upon actuation, respectively, of a spring 264, which pushes towards the fan, and a fluid under pressure which is supplied by means of associated ducts 243 to the said cylinder and which pushes in the opposite direction.

In this configuration the spring 264 constantly keeps the jaw 261b pushed, resulting in closure of the gripper 261 around the armature 262 and therefore the rotation of the fan 10.

In order to interrupt rotation of the fan 10, fluid under pressure is supplied to the cylinder, resulting in the axial displacement of the jaw 261b, against the thrusting action of the spring 264, which causes opening of the gripper 261 with consequent disengagement of the sleeve 51 and stoppage of the fan 10.

In the embodiments illustrated in Figures 3a,3b,3c it is envisaged that the longitudinal support 321a consists of a shaft coaxially inserted inside the fixed mounting block 122 and rotating with respect to the latter by means of respective bearings 321c.

The rotating shaft 321a supports integrally the rotor 321. As illustrated in Fig. 3a and 3b, the engaging/disengaging means are substantially similar to the means already described in connection with Figures 2a,2b and therefore not further described in detail, while the embodiment according to Fig. 3c envisages that permanent magnets 366 are arranged inside the clutch 360 behind the electromagnet 361, these magnets keeping the armature 362 constantly coupled to the rotor 321 and therefore the sleeve 51 and the fan 10 always rotating.

In order to stop rotation of the fan 10, the electromagnet 361 is energized, resulting in the

generation of an electromagnetic field which opposes the force of attraction of the permanent magnets 346, resulting in recall of the armature 362 by the resilient ring 363 with the consequent separation of the sleeve 51 from the rotor 221.

Figs. 4a, 4b show two further embodiments of the apparatus according to the invention wherein the fan 10 is mounted in a central position between the fixed mounting block 422 with means for generating the movement, on one side, and the engaging/disengaging means 460, on the other side, so that the assembly is more compact in the axial direction and therefore subject to smaller forces in the direction transverse to the axis of rotation.

In greater detail (Fig. 4a), the support 422 supports the fan 10 with associated blades 12, adjustment of the angle of which is obtained by means of supplying of a fluid under pressure to channels 443 in a similar manner to that described in connection with Fig. 2a and therefore not further specified.

On the opposite side to that of the mounting block 422, the fan 10 supports, integral therewith, the rotor 421 which is coaxially mounted on the race of a bearing 421d, the other race of which is joined to the armature 462 in turn integral with a spring plate 463 constrained to a bush 463a keyed onto the free end 421b of the actuating shaft 421a. With this configuration, the shaft 421a ensures the constant rotation of the armature 462 which functions in this case as a rotor and which is coupled to the rotor 421 only when the electromagnetic 461 is energized. This means that, in order to ensure ventilation, it is necessary to keep the electromagnet 461 constantly energized and in the event of interruption of the power the ventilation would be halted. In order to overcome this drawback it

is possible to use the configuration according to Fig. 4b which envisages the insertion of a permanent magnet 466 ahead of the electromagnet 461 so that the armature 462 is constantly coupled to the rotor 421. In this case energization of the electromagnet produces an electromagnetic field which neutralises the magnetic field of the permanent magnet 466, resulting in recall of the armature 462 by the spring plate 463 and therefore disengagement of the rotor 421 with consequent stoppage of the fan 10.

The person skilled in the art may interchange the constructional solutions described and illustrated, without thereby departing from the scope of the claims which follow.